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(71) Applicant: **SANDOZ NUTRITION LTD.  
CH-3001 Berne (CH)**

(72) Inventors:

- **Lowry, Carol J.**  
**South Minneapolis, MN 55417 (US)**
- **Schmidl, Mary K.**  
**Arden Hills, MN 55112 (US)**

(74) Representative: **Smolders, Walter et al**  
**Sandoz Technology LTD.,**  
**Patents and Trademarks Division,**  
**Lichtstrasse 35**  
**CH-4002 Basle (CH)**

(54) **Adolescent dietary composition**

(57) A dietary composition for oral or enteral administration to a human adolescent, comprising

a) a carbohydrate component which comprises from 50 to 65% of the total caloric content of said composition;

b) a lipid component which comprises from 20 to 35% of the total caloric content of said composition; and

c) an amino acid component which comprises from 10 to 20% of the total caloric content of said com-

position and which comprises 2.3 to 2.8 L-histidine, 6.1 to 7.4% L-isoleucine, 8.5 to 10.2% L-leucine, 7.0 to 8.4% L-valine, 6.6 to 8.0% L-lysine, 3.1 to 3.8% L-methionine, 5.5 to 6.6% L-phenylalanine, 4.8 to 5.8% L-threonine, 1.7 to 2.1% L-tryptophan, 5.7 to 6.9% L-alanine, 6.2 to 7.5% L-arginine, 5.9 to 7.1% L-aspartic acid, 2.3 to 2.8% L-cystine, 12.9 to 15.5% L-glutamine, 3.8 to 4.6% L-glutamic acid, 3.2 to 3.9% glycine, 5.0 to 6.0% L-proline, 5.4 to 6.5% L-serine, and 4.0 to 4.8% L-tyrosine, all based on total weight of said amino acid component.

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## Description

This invention relates to dietary compositions, useful for providing nutrition to a human adolescent, particularly in the age of 1 to 18 years, for stimulating growth or for diseases or conditions such as inflammatory bowel disease, intractable diarrhea, lactose intolerance, short bowel syndrome, cystic fibrosis, cow's milk protein enteropathy or sensitivity, pre or post surgery, AIDS, malabsorption syndrome, gastroenteritis, GI fistula, and pancreatic disorder.

## BACKGROUND OF THE INVENTION

Providing proper nutrition to adolescents is important in growth and development. Nutrition is especially important to adolescents who are undergoing certain conditions or disease, and who are unable to consume food orally and must be fed enterally. Physicians have had to use baby formulas or modify existing adult enteral formulas to meet the needs of their adolescent patients. They have added fats and carbohydrates to increase the calories, lowered the protein content or reduced the water used in preparing powdered or concentrated varieties. These modifications do not provide for a well-balanced formula as the sodium and vitamins and minerals are not appropriate. Some physicians have added iron, vitamins and calcium, but again an appropriately balanced formula was not achieved. Thus, a strong need exists for improved enteral or oral formulas designed for the nutritional needs of adolescents.

Enteral food compositions containing essential amino acids, minerals and carbohydrates are described in U.S. patent no. 3,697,287. U.S. patent no. 4,368,204 describes elemental nutritional compositions for pediatrics having a specific amino acid profile. However, the compositions of the prior art are not optimal for providing nutrition to human adolescents. These compositions are typically too high in osmolality and relatively low in amount of essential amino acids and other components required for growth.

The present invention overcomes deficiencies of the prior art compositions by providing an improved nutritional composition for adolescents which has an optimal amino acid content.

## DETAILED DESCRIPTION

The compositions of the invention comprise:

- a) a carbohydrate component which comprises from 50 to 65% of the total caloric content of said composition;
- b) a lipid component which comprises from 20 to 35% of the total caloric content of said composition; and
- c) an amino acid component which comprises from 10 to 20% of the total caloric content of said composition and which comprises 2.3 to 2.8% L-histidine, 6.1 to 7.4% L-isoleucine, 8.5 to 10.2% L-leucine; 7.0 to 8.4% L-valine, 6.6 to 8.0% L-lysine, 3.1 to 3.8% L-methionine, 5.5 to 6.6% L-phenylalanine, 4.8 to 5.8% L-threonine; 1.7 to 2.1% L-tryptophan, 5.7 to 6.9% L-alanine, 6.2 to 7.5% L-arginine, 5.9 to 7.1% L-aspartic acid, 2.3 to 2.8% L-cystine, 12.9 to 15.5% L-glutamine, 3.8 to 4.6% L-glutamic acid, 3.2 to 3.9% glycine, 5.0 to 6.0% L-proline, 5.4 to 6.5% L-serine, and 4.0 to 4.8% L-tyrosine, all based on total weight of said amino acid component.

The carbohydrate component of the composition of this invention comprises 50-65% of the total caloric content of the composition, more preferably from 60 to 65% of the total caloric content; most preferably about 63% of the total caloric content. Any carbohydrate conventionally used in nutritional compositions are useful in the composition of this invention, but preferably the carbohydrate component consist essentially of maltodextrin, modified starch or mixtures thereof. The carbohydrate component provides optional absorption of the carbohydrate by the gastro-intestinal tract of adolescent, particularly for those with malabsorption disorders. The carbohydrate component more preferably consist essentially of about 72-99% by weight maltodextrin and about 1-28% by weight modified starch. The carbohydrate component is preferably free of lactose (which may be a problem in adolescents with lactose intolerance) and preferably contains no sucrose or fructose.

The lipid component for the compositions of this invention comprises from 20 to 35% of the total caloric content of the composition, more preferably 20 to 30%, most preferably about 25%. Adequate lipid intake is important as a source of energy, essential fatty acids and carrier of fat soluble vitamins. Suitable lipids for use in the present invention include, any of the conventional saturated and unsaturated fatty acids, glycerides and other nutritionally acceptable fat sources known in the art, such as animal oils, fish oils, vegetable oils and synthetic lipids. Preferably the lipid component consists essentially of soybean oil, medium chain triglycerides, or mixtures thereof. More preferably, the lipid component consists of about 30% by weight soybean oil and about 70% by weight medium chain, triglycerides, based on total weight of said lipid component. Medium chain triglycerides have been shown to be well-utilized in clinical conditions where standard long chain dietary fats are malabsorbed. In addition, medium chain triglycerides contain fatty acid chains composed of

six to ten linear carbon units. These triglycerides do not require emulsification with bile, are more rapidly and more easily hydrolyzed than long chain fats and the fatty acids are directly absorbed into the portal system. Soybean oil is preferred as an excellent source of linoleic and linolenic acids. The composition of the invention comprises preferably about 4.3% of its total energy content as linoleic acid and about 0.6% linolenic acid giving a total of about 4.9% as essential fatty acids.

The lipid component is preferably added or included in the compositions of the invention in the form of dry granules encapsulated by carbohydrate. The encapsulated lipid can be prepared by adding the lipid to an aqueous carbohydrate slurry, homogenizing it, and spray drying it to form the dry granules. The encapsulated lipid provides improved emulsion stability to the compositions of the invention.

The amino acid component of the compositions of this invention comprises from 10 to 20% of the total caloric content of the composition, more preferably 10 to 15%, most preferably about 12%. More preferably the amino acid component comprises 2.4 to 2.6% L-histidine, 6.6 to 6.8% L-isoleucine, 9.2 to 9.5% L-leucine, 7.6 to 7.8% L-valine, 7.1 to 7.4% L-lysine, 3.3 to 3.5% L-methionine, 6.0 to 6.2% L-phenylalanine, 5.2 to 5.4% L-threonine, 1.8 to 2.0% L-tryptophan, 6.2 to 6.4% L-alanine, 6.7 to 6.9% L-arginine, 6.4 to 6.6% L-aspartic acid, 2.4 to 2.6% L-cystine, 14.0 to 14.5% L-glutamine, 4.1 to 4.3 L-glutamic acid, 3.4 to 3.6% glycine, 5.4 to 4.6% L-proline, 5.8 to 6.1% L-serine, and 4.3 to 4.5% L-tyrosine, all based on total weight of said amino acid component. Most preferably the amino acid component comprises about 2.5% L-histidine, 6.7% L-isoleucine, 9.4% L-leucine, 7.7% L-valine, 7.3% L-lysine, 3.4% L-methionine, 6.1% L-phenylalanine, 5.3% L-threonine, 1.9% L-tryptophan, 6.3% L-alanine, 6.8% L-arginine, 6.5% L-aspartic acid, 2.5% L-cystine, 14.2% L-glutamine, 4.2% L-glutamic acid, 3.5% glycine, 5.5% L-proline, 5.9% L-serine, and 4.4% L-tyrosine, all based on total weight of said amino acid component.

The compositions of this invention preferably contain 100% free amino acids specially designed to provide a balance of amino acids for adolescents. This balance of amino acids is hypo-allergenic in comparison to intact protein used in other formulas. Free amino acids may have a unique benefit in the dietary management of adolescents sensitive to intact protein and for feeding adolescents with severe and persistent diarrhea. The amino acid profile of the present compositions meets or exceeds the standard for high quality proteins established by the National Academy of Science-National Research Council. The preferred non-protein calorie to nitrogen ratio to 200:1 and preferred total calorie to nitrogen ratio of 227:1 will meet the needs of adolescent patients. In general, protein requirements are increased during stress due to increased losses and greater needs for anabolism and tissue repair. Studies have shown the enteral fortification employing sufficient quantities of protein can accelerate the synthesis of visceral protein and promote positive nitrogen balance and host defense factors. However, excessive levels of protein are contra-indicated because of the resulting increase in renal solute load.

The amino acid component preferably comprises 9.5 to 11.5% by weight aromatic amino acid (such as phenylalanine and tyrosine) and 5.4 to 6.5% by weight sulfur-containing amino acids (such as methionine and cystine), based on total weight of the amino acid component. These are believed to be among the most important amino acids for growth in adolescents.

The compositions of the invention preferably contain L-carnitine and taurine. Adequate levels of L-carnitine are essential for lipid metabolism. The compositions preferably contain from about 0.01 to about 0.02% by weight based on total dry weight of the composition L-carnitine. Taurine is important for normal retinal development and in the synthesis of bile salts. Taurine also aids in improved fat absorption, growth and weight gain. The preferred compositions contain about 0.04 to 0.05% by weight taurine based on total dry weight of the composition.

The compositions of the invention can be in the form of a solid powder, this powder is subsequently dissolved or dispersed in juices, water or other aqueous based, non-protein medium. The solid powder form preferably has a caloric content from about 4-5 calories per gram of the composition. The compositions can also be in the form of a ready-to-use aqueous liquid which preferably has a caloric content of about 0.8 calorie per milliliter. The aqueous compositions of the invention preferably have an osmolality of about 300 to 400 mOsm per kilogram of water; more preferably about 350 to 370 mOsm/kg; most preferably about 360 mOsm/kg. Likewise, 0.22 grams of the dry powder composition in 1 gram of water has an osmolality of 300 to 400 mOsm.

Preferred compositions of the invention have the following formulation, based on total dry weight of the composition:

	<u>Ingredient</u>	<u>% by weight</u>	
5	Maltodextrin	42.5960	to 52.0618
	Modified starch	16.3556	to 19.9901
	Medium chain triglycerides	7.5770	to 9.2608
10	Soybean oil	3.2834	to 4.0130
	Calcium glycerophosphate	2.8007	to 3.4231
	Magnesium gluconate	1.8886	to 2.3083
15	L-glutamine	1.4374	to 1.7568
	L-lysine acetate	1.0375	to 1.2681
	L-leucine	0.9471	to 1.1576
20	L-arginine acetate	0.9289	to 1.1354
	Potassium Chloride	0.7879	to 0.9630
	L-valine	0.7800	to 0.9533
25	Citric acid	0.7428	to 0.9079
	L-isoleucine	0.6797	to 0.8307
	L-aspartic acid	0.6574	to 0.8035
30	L-alanine	0.6351	to 0.7763
	L-phenylalanine	0.6128	to 0.7490
	L-serine	0.6017	to 0.7354
35	Polyglycerol ester	0.5669	to 0.6929
	L-proline	0.5571	to 0.6809
40	L-threonine	0.5348	to 0.6537
	L-tyrosine	0.4457	to 0.5448
	L-glutamic acid	0.4234	to 0.5175
45	Potassium citrate	0.3580	to 0.4376
	Glycine	0.3566	to 0.4358
	L-histadine hydrochloride	0.3463	to 0.4233
50	L-methionine	0.3454	to 0.4222

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	Sodium citrate	0.2764	to	0.3378
	L-cystine	0.2563	to	0.3132
5	Choline bitartrate	0.2386	to	0.2916
	L-tryptophan	0.1894	to	0.2315
	Sodium Phosphate dibasic	0.1818	to	0.2223
10	Potassium sorbate	0.1746	to	0.2134
	Ascorbic acid	0.0938	to	0.1146
	Alpha tocopheryl acetate	0.0836	to	0.1021
15	Beta carotene	0.0487	to	0.0595
	Taurine	0.0415	to	0.0507
	M-inositol	0.0338	to	0.0413
20	Zinc sulfate	0.0178	to	0.0218
	Ferrous sulfate	0.0165	to	0.0201
	Niacinamide	0.0133	to	0.0162
25	L-carnitine	0.0130	to	0.0158
	Biotin	0.0065	to	0.0079
30	Copper gluconate	0.0047	to	0.0057
	Calcium pantothenate	0.0037	to	0.0046
	Vitamin A palmitate	0.0037	to	0.0045
35	Manganese sulfate	0.0033	to	0.0041
	Vitamin D <sub>3</sub>	0.0032	to	0.0040
	Vitamin K <sub>1</sub>	0.0025	to	0.0031
40	Cyanocobalamin	0.0020	to	0.0025
	Potassium Iodide	0.0018	to	0.0021
	Pyridoxine hydrochloride	0.0016	to	0.0020
45	Folic acid	0.0013	to	0.0016
	Riboflavin	0.0012	to	0.0015
	Thiamine hydrochloride	0.0010	to	0.0013
50	Chromic acetate monohydrate	0.00010	to	0.00011
	Sodium molybdate	0.00010	to	0.00011
55	Sodium selenite anhydrous	0.000040	to	0.000044
	<b>TOTAL</b>		<b>100</b>	

The most preferred composition comprises, based on total dry weight of the compositions:

	Maltodextrin	47.3289
5	Modified starch	18.1728
	Medium chain triglycerides	8.4189
	Soybean oil	3.6482
10	Calcium glycono-phosphate	3.1119
	Magnesium gluconate	2.0985
	L-glutamine	1.5971
15	L-lysine acetate	1.1528
	L-leucine	1.0524
	L-arginine acetate	1.0321
20	Potassium Chloride	0.8755
	L-valine	0.8667
	Citric acid	0.8254
25	L-isoleucine	0.7552
	L-aspartic acid	0.7305
	L-alanine	0.7057
30	L-phenylalanine	0.6809
	L-serine	0.6686
	Polyglycerol ester	0.6299
35	L-proline	0.6190
	L-threonine	0.5943
	L-tyrosine	0.4952
40	L-glutamic acid	0.4705
	Potassium citrate	0.3978
	Glycine	0.3962
45	L-histidine hydrochloride	0.3848
	L-methionine	0.3838
50	Sodium citrate	0.3071
	L-cystine	0.2848

	Choline bitartrate	0.2651
5	L-tryptophan	0.2105
	Sodium Phosphate dibasic	0.2021
	Potassium sorbate	0.1940
10	Ascorbic acid	0.1042
	Alpha tocopheryl acetate	0.0929
	Beta carotene	0.0541
15	Taurine	0.0461
	M-inositol	0.0375
	Zinc sulfate	0.0198
20	Ferrous sulfate	0.0183
	Niacinamide	0.0147
	L-carnitine	0.0144
25	Biotin	0.0072
	Copper gluconate	0.0052
	Calcium pantothenate	0.0042
30	Vitamin A palmitate	0.0041
	Manganese sulfate	0.0037
35	Vitamin D <sub>3</sub>	0.0036
	Vitamin K <sub>1</sub>	0.0028
	Cyanocobalamin	0.0023
40	Potassium Iodide	0.0019
	Pyridoxine hydrochloride	0.0018
	Folic acid	0.0014
45	Riboflavin	0.0013
	Thiamine hydrochloride	0.0012
	Chromic acetate monohydrate	0.0001
50	Sodium molybdate	0.0001
	Sodium selenite anhydrous	0.00004
55	<b>TOTAL</b>	<b>100</b>

The enteral nutritional compositions of this invention may be administered via a nasogastric, nasointestinal, esophagostomy, gastrostomy, or jejunostomy feeding tube. Because of its homogeneity and low viscosity, small bore feed-

ing tubes (16 gauge catheter or #5 French tube) may be used to optimize patient tolerance. The diet should be given at room temperature by continuous drip technique, or using a suitable infusion pump. At the 0.8 calorie per ml dilution, the composition supplies most of the daily fluid requirement. Additional fluids should be given when necessary to maintain hydration and adequate urine output.

The compositions can also be administered orally, such as a flavored drink served chilled over ice. The compositions of the invention are useful for administering complete nutrition or nutritional supplement to adolescents preferably ages 1 to 18 years, more preferably ages 1 to 10 years, most preferably ages 1 to 6 years. The compositions are preferably administered in an amount providing at least 800 calories per day. The compositions are particularly useful for administering to an adolescent for diseases or conditions such as inflammatory bowel disease, intractable diarrhea, lactose intolerance, short bowel syndrome, cystic fibrosis, cow's milk protein enteropathy or sensitivity, pre or post surgery, trauma, AIDS, malabsorption syndrome, gastroenteritis, GI fistula, and pancreatic disorder.

The following examples are presented to help demonstrate this invention. The examples are intended to be illustrative and not limitative.

#### EXAMPLE 1

A dietary composition (sample #8773) having an amino acid profile within the scope of the present invention was compared to a dietary composition containing casein as the standard protein source. These compositions had the following formulations:

<u>Ingredients</u>	<u>Amount (wt. %)</u>	
	<u>Sample #8773</u>	<u>Casein Composition</u>
Casein	-	11.14
Amino Acid Mix*	11.70	-
Cottonseed Oil	8.00	7.96
Vitamin Mix	1.00	1.00
Salt Mixture	5.00	4.81
Non-nutritive fiber	1.00	1.00
Corn starch	34.15	34.15
Sucrose	34.15	35.59
Water	5.00	4.35

\* The Amino acid mix comprises:



	<u>Ingredient</u>	<u>% by weight</u>
5	L-glutamine	12.2
	L-leucine	8.0
	L-arginine acetate	7.9
10	L-lysine acetate	8.8
	L-isoleucine	5.8
	L-valine	6.6
15	L-phenylalanine	5.2
	L-methionine	2.9
	L-threonine	4.5
20	L-tyrosine	3.8
	L-histidine hydrochloride	2.9
	L-aspartic acid	5.6
25	L-proline	4.7
	L-tryptophan	1.6
	L-serine	5.1
30	L-alanine	5.4
	glycine	3.0
35	L-glutamic acid	3.6
	L-cystine	2.2

40 The compositions were compared for Protein Efficiency Ratio (PER) which is a measure of protein quality using laboratory rats. PER is determined by dividing the animal's weight gain by protein intake. Two groups of ten rats each were fed a diet, for 28 days, of Sample #8773 and the casein composition, respectively. Every seven days the rats were weighed and their food consumption was recorded. At the end of 28 days, the total weight gain and protein consumption of the two groups were calculated. These values were used to calculate the PER.

45 The results for the casein composition are presented in Table 1 and in Table 2 for Sample #8773 of the invention.

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Table 1  
(Casein Composition)  
BODY WEIGHTS - GMS  
WEEKS

ANIMAL NUMBER	0	1	2	3	4	WT. GAIN
1	65	82	106	129	162	97
2	64	84	106	129	156	92
3	61	81	104	129	164	103
4	62	78	99	119	155	93
5	65	89	119	144	183	118
6	61	80	111	139	167	106
7	62	80	102	129	158	96
8	63	87	113	135	173	110
9	66	87	115	142	179	113
10	64	91	124	152	189	125
MEAN	63	84	110	135	169	105
SD	1.77	4.38	7.92	9.63	11.90	11.16

**FEED CONSUMPTION - GMS  
WEEKS**

ANIMAL NUMBER	1	2	3	4	TOTAL	PROTEIN	PER*
1	69	97	96	98	360	36.0	2.69
2	75	88	96	95	354	35.4	2.60
3	69	86	89	103	347	34.7	2.97
4	72	81	87	114	354	35.4	2.63
5	81	101	109	121	412	41.2	2.86
6	73	96	109	106	384	38.4	2.76
7	74	84	101	112	371	37.1	2.59
8	80	89	94	116	379	37.9	2.90
9	78	98	102	120	398	39.8	2.84
10	85	107	113	129	434	43.4	2.88
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MEAN	76	93	100	111	379	37.9	2.77
SD	5.30	8.33	8.77	10.81	28.28	2.83	.138

\* PER = Protein Efficiency Ratio

**TABLE 2 (SAMPLE #8773)  
BODY WEIGHTS - GMS.  
WEEKS.**

ANIMAL NUMBER	0	1	2	3	4	WT. GAIN
1	64	105	163	216	272	208
2	65	93	138	182	225	160
3	63	91	133	179	231	168
4	62	94	150	198	250	188
5	60	86	128	164	202	142
6	62	86	130	175	218	156
7	61	87	129	177	222	161
8	62	86	129	172	211	149

9	60	89	139	190	241	181
10	61	85	125	171	214	153

<b>MEAN</b>	<b>62</b>	<b>90</b>	<b>136</b>	<b>182</b>	<b>229</b>	<b>167</b>
<b>SD</b>	<b>1.63</b>	<b>6.09</b>	<b>11.85</b>	<b>15.28</b>	<b>20.82</b>	<b>20.19</b>

# **FEED CONSUMPTION - GMS WEEKS**

<b>ANIMAL NUMBER</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>TOTAL</b>	<b>PROTEIN</b>	<b>PER</b>
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<b>1</b>	<b>94</b>	<b>133</b>	<b>148</b>	<b>153</b>	<b>528</b>	<b>52.8</b>	<b>3.94</b>
<b>2</b>	<b>82</b>	<b>120</b>	<b>138</b>	<b>141</b>	<b>481</b>	<b>48.1</b>	<b>3.33</b>
<b>3</b>	<b>74</b>	<b>113</b>	<b>136</b>	<b>145</b>	<b>468</b>	<b>46.8</b>	<b>3.59</b>
<b>4</b>	<b>82</b>	<b>133</b>	<b>139</b>	<b>146</b>	<b>500</b>	<b>50.0</b>	<b>3.76</b>
<b>5</b>	<b>70</b>	<b>110</b>	<b>119</b>	<b>119</b>	<b>418</b>	<b>41.8</b>	<b>3.40</b>
<b>6</b>	<b>77</b>	<b>114</b>	<b>134</b>	<b>136</b>	<b>461</b>	<b>46.1</b>	<b>3.38</b>
<b>7</b>	<b>80</b>	<b>107</b>	<b>130</b>	<b>132</b>	<b>449</b>	<b>44.9</b>	<b>3.59</b>
<b>8</b>	<b>79</b>	<b>110</b>	<b>124</b>	<b>125</b>	<b>438</b>	<b>43.8</b>	<b>3.40</b>
<b>9</b>	<b>89</b>	<b>132</b>	<b>153</b>	<b>150</b>	<b>524</b>	<b>52.4</b>	<b>3.45</b>
<b>10</b>	<b>74</b>	<b>105</b>	<b>126</b>	<b>128</b>	<b>433</b>	<b>43.3</b>	<b>3.53</b>

<b>MEAN</b>	<b>80</b>	<b>118</b>	<b>135</b>	<b>138</b>	<b>470</b>	<b>47.0</b>	<b>3.54</b>
<b>SD</b>	<b>7.20</b>	<b>11.10</b>	<b>10.55</b>	<b>11.35</b>	<b>37.89</b>	<b>3.79</b>	<b>.191</b>

The results show that compositions having the amino acid profile of this invention have a significantly greater protein efficiency ratio than the conventional casein protein.

## **EXAMPLE 2**

A dietary composition within the scope of this invention (Sample A) was prepared and compared to a dietary composition described in U.S. Patent No. 4,368,204 (Sample B).

Sample A of this invention had the following composition:

	<u>Ingredient</u>	<u>% by weight</u>
5	Maltodextrin	47.3289
	Modified starch	18.1728
	Medium chain triglycerides (MCT)	8.4189S
10	Soybean oil	3.6482
	Calcium glycerophosphate	3.1119
	Magnesium gluconate	2.0985
15	L-glutamine	1.5971
	L-lysine acetate	1.1528
	L-leucine	1.0524
20	L-arginine acetate	1.0321
	Potassium Chloride	0.8755
	L-valine	0.8667
25	Citric acid	0.8254
	L-isoleucine	0.7552
	L-aspartic acid	0.7305
30	L-alanine	0.7057
	L-phenylalanine	0.6809
	L-serine	0.6686
35	Polyglycerol ester	0.6299
	L-proline	0.6190
	L-threonine	0.5943
40	L-tyrosine	0.4952
	L-glutamic acid	0.4705
45	Potassium citrate	0.3978

	Glycine	0.3962
	L-histidine hydrochloride chloride	0.3848
5	L-methionine	0.3838
	Sodium citrate	0.3071
	L-cystine	0.2848
10	Choline bitartrate	0.2651
	L-tryptophan	0.2105
	Sodium Phosphate dibasic	0.2021
15	Potassium sorbate	0.1940
	Ascorbic acid	0.1042
	Alpha tocopherylacetate	0.0929
20	Beta carotene	0.0541
	Taurine	0.0461
	M-inositol	0.0375
25	Zinc sulfate	0.0198
	Ferrous sulfate	0.0183
30	Niacinamide	0.0147
	L-carnitine	0.0144
	Biotin	0.0072
35	Copper gluconate	0.0052
	Calcium pantothenate	0.0042
	Vitamin A palmitate	0.0041
40	Manganese sulfate	0.0037
	Vitamin D <sub>3</sub>	0.0036
	Vitamin K <sub>1</sub>	0.0028
45	Cyanocobalamin	0.0023
	Potassium Iodide	0.0019
	Pyridoxine hydrochloride	0.0018
50	Folic acid	0.0014
	Riboflavin	0.0013
	Thiamine hydrochloride	0.0012
55	Chromic acetate monohydrate	0.0001

Sodium molybdate	0.0001
Sodium selenite anhydrous	0.00004

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<b>Total</b>	<b>100</b>
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The caloric content of Sample A was 12% amino acid, 25% lipid and 63% carbohydrate.  
Comparative Sample B had the following composition:

<u>Ingredient</u>	<u>% by wt.</u>
Dextrin	82.40478
soybean oil	3.14522
L-leucine	1.31575
L-proline	1.27906
L-alanine	1.25809
L-lysine monohydrochloride	1.24367
L-serine	1.15718
L-glutamic acid	0.97895
L-arginine	0.90818
N-acetyl-L-tyrosine	0.70505
L-valine	0.70374
L-isoleucine	0.68015
L-threonine	0.65001
L-histidine hydrochloride	0.49799
L-cystine hydrochloride monohydrate	0.41019
L-phenylalanine	0.40626
di-L-aspartic acid monomagnesium	0.35842
L-aspartic acid monopotassium	0.35842
glycine	0.29749
Zinc sulfate heptahydrate	0.28137
L-tryptophan	0.24375

	L-methionine	0.20837
	potassium sorbate	0.15726
5	polysorbate 80	0.15412
	ferrous gluconate	0.05762
	choline bitartrate	0.03916
10	ascorbic acid	0.03748
	soy lecithin	0.02202
	vitamin K	0.01922
15	cupric sulfate pentahydrate	0.00180
	tocopherol acetate	0.00722
	Niacinamide	0.00481
20	Manganese sulfate pentahydrate	0.00285
	Calcium pantothenate	0.00260
25	pyridoxine hydrochloride	0.00058
	retinol acetate	0.00049
	thiamine hydrochloride	0.00042
30	folic acid	0.00010
	biotin	0.00009
	riboflavine sodium phosphate	0.00006
35	ergocalciferol, D <sub>2</sub>	0.00001
	cyanocobalamin	0.000001

**Total****100**

The caloric content of Sample B was approximately 13% protein, 8% lipid and 79% carbohydrate.

Approximately 60-80 grams of Sample A and B, respectively, were dissolved in warm water to give 300 ml of solution. These solutions were prepared and visually evaluated by five individuals for instancy and solubility using a 5-point scale with 1=poor and 5=excellent. Instancy is defined as the amount of time with which the composition goes into solution and solubility is defined as quantity of insoluble particulates floating on the surface after the majority of the composition has gone into solution. The compositions were also visually evaluated for foaming, on the surface of the solution. The results of these evaluations are presented in Table 3.

TABLE 3

	Sample A	Sample B (average rating)
Instancy	3.2	1.4
Solubility	2.6	1.8
Foaming	none	4 millimeters

Comparative Sample B exhibited lumps of product floating on the surface after mixing and there were no lumps of



product floating on the surface for Sample A of the invention. Comparative Sample B had a white particulate layer form on the bottom of the solution after sitting approximately 5 minutes whereas Sample A had no such sediment.

### EXAMPLE 3

The composition of this invention, (Sample A) and the comparative composition (Sample B) prepared in Example 2 were rated for protein quality according to the Food and Agriculture Organization of the United Nations/ World Health Organization, Joint FAO/WHO Expert Consultation on Protein Quality Evaluation (1989), which is herein incorporated by reference. The compositions were given a score in comparison to egg having a score of 100 as the reference protein. The results of this scoring are presented in Table 4.

TABLE 4

Amino acid	Reference Protein (Egg) (mg/g)	Sample A		Sample B	
		Amino Acid value (mg/g)	% of Reference Protein	Amino Acid value (mg/g)	% of Ref. Protein
L-Histidine	22	23	105	24.3	110
L-Isoleucine	54	61	113	45	83
L-Leucine	86	85	99	87	101
L-Lysine	70	66	94	65.8	94
L-Methionine + L-cystine	57	54	95	32.5	57
L-Phenylalanine + L-tyrosine	93	95	102	64.8	70
L-Threonine	47	48	102	43	91
L-Tryptophan	17	17	100	16.2	95
L-Valine	66	70	106	46.5	70
Chemical Score	100		94		57

This scoring shows that the essential amino acid component of the composition of the present invention is of higher quality than that of the comparative prior art composition. The scoring means that there is a limiting amino acid in the composition of this invention which is 94% of the egg reference protein, whereas the limiting amino acid of the comparative composition is only 57% of the egg reference protein.

### Claims

1. A dietary composition for oral or enteral administration to a human adolescent, comprising

a) a carbohydrate component which comprises from 50 to 65% of the total caloric content of said composition;

b) a lipid component which comprises from 20 to 35% of the total caloric content of said composition; and

c) an amino acid component which comprises from 10 to 20% of the total caloric content of said composition and which comprises 2.3 to 2.8 L-histidine, 6.1 to 7.4% L-isoleucine, 8.5 to 10.2% L-leucine, 7.0 to 8.4% L-valine, 6.6 to 8.0% L-lysine, 3.1 to 3.8% L-methionine, 5.5 to 6.6% L-phenylalanine, 4.8 to 5.8% L-threonine, 1.7 to 2.1% L-tryptophan, 5.7 to 6.9% L-alanine, 6.2 to 7.5% L-arginine, 5.9 to 7.1% L-aspartic acid, 2.3 to 2.8% L-cystine, 12.9 to 15.5% L-glutamine, 3.8 to 4.6% L-glutamic acid, 3.2 to 3.9% glycine, 5.0 to 6.0% L-proline, 5.4 to 6.5% L-serine, and 4.0 to 4.8% L-tyrosine, all based on total weight of said amino acid component.

2. The composition of claim 1 wherein said carbohydrate component comprises from 60 to 65% of the total caloric

content of said composition.

3. The composition of Claims 1 or 2, wherein said lipid component comprises from 20 to 30% of the total caloric content of said composition.

4. The composition of Claims 1 to 3, wherein said amino acid component comprises from 10 to 15% of the total caloric content of said composition.

5. The composition of Claims 1 to 4, wherein said amino acid component comprises 2.4 to 2.6% L-histidine, 6.6 to 6.8% L-isoleucine, 9.2 to 9.5% L-leucine, 7.6 to 7.8% L-valine, 7.1 to 7.4% L-lysine, 3.3 to 3.5% L-methionine, 6.0 to 6.2% L-phenylalanine, 5.2 to 5.4% L-threonine, 1.8 to 2.0% L-tryptophan, 6.2 to 6.4% L-alanine, 6.7 to 6.9% L-arginine, 6.4 to 6.6% L-aspartic acid, 2.4 to 2.6% L-cystine, 14.0 to 14.5% L-glutamine, 4.1 to 4.3 L-glutamic acid, 3.4 to 3.6% glycine, 5.4 to 5.6% L-proline, 5.8 to 6.1% L-serine, and 4.3 to 4.5% L-tyrosine based on total weight of said amino acid component.

6. The composition of Claim 5 wherein said amino acid component comprises about 2.5% L-histidine, 6.7% L-isoleucine, 9.4% L-leucine, 7.7% L-valine, 7.3% L-lysine, 3.4% L-methionine, 6.1% L-phenylalanine, 5.3% L-threonine, 1.9% L-tryptophan, 6.3% L-alanine, 6.8% L-arginine, 6.5% L-aspartic acid, 2.5% L-cystine, 14.2% L-glutamine, 4.2% L-glutamic acid, 3.5% glycine, 5.5% L-proline, 5.9% L-serine, and 4.4% L-tyrosine based on total weight of said amino acid component.

7. The composition of Claims 1 to 6, wherein said carbohydrate component consists essentially of maltodextrin, modified starch or mixtures thereof.

8. The composition of Claims 1 to 7, wherein said lipid component consists essentially of soybean oil, medium chain triglycerides or mixtures thereof.

9. The composition of Claims 1 to 8, wherein said composition is in a dry powder form.

10. The composition of Claims 1 to 9, wherein said composition is dissolved or dispersed in a non-protein, aqueous-based medium.

11. The composition of Claim 10, wherein said composition has a caloric density of about 0.8 calories/ml and an osmolality of 300 to 400 mOsm/kg.

12. The composition of Claims 1 to 11, wherein 0.22 grams of said composition in 1 gram of water has an osmolality of 300 to 400 mOsm/kg.

13. The composition of Claims 1 to 12 comprising based on total dry weight of said composition:

<u>Ingredient</u>	<u>% by weight</u>		
Maltodextrin	42.5960	to	52.0618
Modified starch	16.3556	to	19.9901
Med.chain triglycerides	7.5770	to	9.2608
Soybean oil	3.2834	to	4.0130
Calcium glycerophosphate	2.8007	to	3.4231
Magnesium gluconate	1.8886	to	2.3083
L-glutamine	1.4374	to	1.7568
L-lysine acetate	1.0375	to	1.2681
L-leucine	0.9471	to	1.1576
L-arginine acetate	0.9289	to	1.1354
Potassium Chloride	0.7879	to	0.9630
L-valine	0.7800	to	0.9533
Citric acid	0.7428	to	0.9079
L-isoleucine	0.6797	to	0.8307
L-aspartic acid	0.6574	to	0.8035
L-alanine	0.6351	to	0.7763
L-phenylalanine	0.6128	to	0.7490
L-serine	0.6017	to	0.7354
Polyglycerol ester	0.5669	to	0.6929
L-proline	0.5571	to	0.6809
L-threonine	0.5348	to	0.6537
L-tyrosine	0.4457	to	0.5448
L-glutamic acid	0.4234	to	0.5175
Potassium citrate	0.3580	to	0.4376
Glycine	0.3566	to	0.4358
L-histidine hydrochloride	0.3463	to	0.4233
L-methionine	0.3454	to	0.4222

	Sodium citrate	0.2764	to	0.3378
	L-cystine	0.2563	to	0.3132
5	Choline bitartrate	0.2386	to	0.2916
	L-tryptophan	0.1894	to	0.2315
	Sodium Phosphate dibasic	0.1818	to	0.2223
10	Potassium sorbate	0.1746	to	0.2134
	Ascorbic acid	0.0938	to	0.1146
	Alpha tocopheryl acetate	0.0836	to	0.1021
15	Beta carotene	0.0487	to	0.0595
	Taurine	0.0415	to	0.0507
	M-inositol	0.0338	to	0.0413
20	Zinc sulfate	0.0178	to	0.0218
	Ferrous sulfate	0.0165	to	0.0201
	Niacinamide	0.0133	to	0.0162
25	L-carnitine	0.0130	to	0.0158
	Biotin	0.0065	to	0.0079
	Copper gluconate	0.0047	to	0.0057
30	Calcium pantothenate	0.0037	to	0.0046
	Vitamin A palmitate	0.0037	to	0.0045
35	Manganese sulfate	0.0033	to	0.0041
	Vitamin D <sub>3</sub>	0.0032	to	0.0040
	Vitamin K <sub>1</sub>	0.0025	to	0.0031
40	Cyanocobalamin	0.0020	to	0.0025
	Potassium Iodide	0.0018	to	0.0021
	Pyridoxine hydrochloride	0.0016	to	0.0020
45	Folic acid	0.0013	to	0.0016
	Riboflavin	0.0012	to	0.0015
	Thiamine hydrochloride	0.0010	to	0.0013
50	Chromic acetate monohydrate	0.00010	to	0.00011
	Sodium molybdate	0.00010	to	0.00011
	Sodium selenite anhydrous	0.000040	to	0.000044
55	<b>Total</b>	<b>100</b>		

14. The composition of Claim 13 comprising, based on total dry weight of said composition:

	<b><u>Ingredient</u></b>	<b><u>% by weight</u></b>
5	Maltodextrin	47.3289
	Modified starch	18.1728
	Medium chain triglycerides	8.4189
10	Soybean oil	3.6482
	Calcium glycerophosphate	3.1119
	Magnesium gluconate	2.0985
15	L-glutamine	1.5971
	L-lysine acetate	1.1528
	L-leucine	1.0524
20	L-arginine acetate	1.0321
	Potassium Chloride	0.8755
	L-valine	0.8667
25	Citric acid	0.8254
	L-isoleucine	0.7552
	L-asparic acid	0.7305
30	L-alanine	0.7057
	L-phenylalanine	0.6809
	L-serine	0.6686
35	Polyglycerol ester	0.6299
	L-proline	0.6190
40	L-threonine	0.5943
	L-tyrosine	0.4952
	L-glutamic acid	0.4705
45	Potassium citrate	0.3978
	Glycine	0.3962
	L-histidine hydrochloride	0.3848
50	L-methionine	0.3838
	Sodium citrate	0.3071

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	L-cystine	0.2848
	Choline bitartrate	0.2651
5	L-tryptophan	0.2105
	Sodium Phosphate dibasic	0.2021
	Potassium sorbate	0.1940
10	Ascorbic acid	0.1042
	Alpha tocopheryl acetate	0.0929
	Beta carotene	0.0541
15	Taurine	0.0461
	M-inositol	0.0375
	Zinc sulfate	0.0198
20	Ferrous sulfate	0.0183
	Niacinamide	0.0147
	L-carnitine	0.0144
25	Biotin	0.0072
	Copper gluconate	0.0052
	Calcium pantothenate	0.0042
30	Vitamin A palmitate	0.0041
	Manganese sulfate	0.0037
35	Vitamin D <sub>3</sub>	0.0036
	Vitamin K <sub>1</sub>	0.0028
	Cyanocobalamin	0.0023
40	Potassium Iodide	0.0019
	Pyridoxine hydrochloride	0.0018
	Folic acid	0.0014
45	Riboflavin	0.0013
	Thiamine hydrochloride	0.0012
	Chromic acetate monohydrate	0.0001
50	Sodium molybdate	0.0001
	Sodium selenite anhydrous	0.00004
55	<b>Total</b>	<b>100</b>

15. The composition of Claims 1 to 14, wherein said amino acid component comprises from 5.4 to 6.5% by weight sulfur-containing amino acids.

16. The composition of Claims 1 to 15, wherein said amino acid component comprises 9.5 to 11.5% by weight aromatic amino acids.

17. The composition of Claims 1 to 16, wherein said lipid component is in the form of dry granules encapsulated by carbohydrate.

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European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 95 81 0580

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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Y	J. AM. DIET. ASSOC., 1994, vol. 94, no. 8, August 1994, pages 884-887, DUBIN S 'Essential amino acid reference profile affects the evaluation of enteral feeding products.' * page 885 *	1-17	
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A,D	EP-A-0 034 034 (AJINOMOTO KK) 19 August 1981 * claim 1 *		
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 11 January 1996	Examiner Bendl, E
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

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